

PROJECT FACT SHEET

CONTRACT TITLE: Advanced Tiltmeter Hydraulic Fracture Imaging Technology (PARTNERSHIP)

ID NUMBER: P-31

B&R CODE: AC1005000

CONTRACTOR: Lawrence Livermore National Laboratory

Sandia Nat'l Lab

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PROJECT SITE

CITY: Livermore

STATE: CA

CITY:

STATE:

CITY:

STATE:

CONTRACT PERFORMANCE PERIOD:

08/01/1995 to 03/31/2000

PROGRAM: Supporting Research

RESEARCH AREA: Partnership/Oil Recovery Technology

PRODUCT LINE: RLE

FUNDING (1000'S)	DOE	CONTRACTOR	TOTAL
PRIOR FISCAL YRS	833	4750	5583
FISCAL YR 2000	0	0	0
FUTURE FUNDS	0	0	0
TOTAL EST'D FUNDS	833	4750	5583

OBJECTIVE: Complete tiltmeter leveling mechanism for deviated and horizontal wells. Complete computer simulation of hydraulic fractures.

PROJECT DESCRIPTION:

Background: The successful use of tiltmeters in the oil and gas industry has demonstrated that they are a robust tool for imaging hydraulic fracture orientation and dip angle. However, there is also a need to get a clear picture of the fracture geometry, specifically the length and height. The fracture height is important because it helps producers to know which rock strata are being accessed by the fracture, to verify whether all pay zones are being intersected, and to avoid intersecting aquifers. Knowing fracture length helps producers design optimal fracture treatments, evaluate infill well spacing, and allows estimation of formation permeability from production response.

A "first generation" vertical array of recoverable tiltmeters have been developed and installed in an array in a borehole near an injection well. These arrays have been developed to reduce tool diameter so they can be used in 5-1/2 inch casing and formation temperatures to 70C (160F).

Work to be Performed: The primary objective is to develop a computer model that will advance the state-of-the-art in tiltmeter mapping.

Significant advances in tiltmeter instrumentation has been made and the current near-surface tiltmeter has an order of magnitude less noise than previous tiltmeters.

The new tiltmeter has been modified to be used in a vertical array of tools in wells to map the fracture height of a hydraulic fracture treatment in a nearby well.

Often it is not economically viable to test the limits of the tiltmeter technology by field tests. Many deployment scenarios can be tested with a computer model. Therefore simulation will be used before actual field tests to determine the probability of success.

PROJECT STATUS:

Current Work: The objective of the project has been changed to working with deviated and horizontal wells.

Scheduled Milestones:

Capture leveling mechanism design on CAD system
Complete computer modeling and write final report

03/00

04/00

Accomplishments: These are the FY 1996 to Present accomplishments: 1) Developed and tested self-leveling tiltmeter w/internal data storage. 2) Achieved initial goal, imaging a 10,000 foot deep hydraulic fracture. 3) Won an R&D 100 award, often called "the Oscar of Inventions". These awards are given to the 100 most technologically significant products of the year. 4) Modified the near-surface tiltmeter for use in downhole applications. 5) Successfully tested a vertical array of downhole tiltmeters to measure the hydraulic height in a near by well. 6) Designed and developed a high temperature electronics (120 C or 250F) for the downhole tiltmeter. 7) Developed software to control the high temperature electronics for the downhole tiltmeter. 8) Perform dozens of downhole tiltmeter mappings. 9) Used real time analysis of downhole tilt data to stop hydraulic fractures that were starting to grow out of the pay zone. 10) Designed and started manufacture of leveling mechanism that will enable downhole tiltmeter mapping in highly deviated and horizontal wells. 11) Studied existing tiltmeter mapping computer models and developed a plan for improving the state-of-the-art.